

Section 6

BASINS Assessment Tools

Three main geographically based tools—**TARGET**, **ASSESS**, and **Data Mining**—were developed to assess in-stream water quality conditions and point source discharges at the regional, watershed, and stream segment levels. These tools and their applications are described in this section. They are designed to work jointly to allow the user to perform regional assessments, identify hot spots at a watershed scale, define water quality and point source discharge conditions within watershed boundaries, and access and review summary data at a site-specific scale. In addition, using overlays of various BASINS data in conjunction with these assessment tools provides a powerful approach to establish preliminary relationships between in-stream water quality conditions and potential sources and causes.

TARGET Performs a broad-based assessment on the entire extracted project area (region or state)

ASSESS Used to assess data on an individual watershed (cataloging unit) or a limited set of watersheds.

Data Mining Generates dynamic links between tables and maps for individual water quality stations or permitted facility discharges. In addition, **Data Mining** also operates on the bacteria monitoring station data layer.

6.1 TARGET

Purpose

TARGET is used to perform broad-based water quality and/or point source loading data evaluations on the entire extracted project area.

Application

The BASINS **TARGET** tool allows the user to make a broad-based evaluation of watershed conditions using water quality and/or point source loadings data included in the BASINS system. **TARGET** is designed to perform analysis on the entire project area extracted (e.g., EPA Region, state) and is best suited for project areas that include more than one watershed (cataloging unit). It is designed to integrate and process a large amount of detailed, site-specific data associated with a project area and to summarize the results on a watershed basis. Using water quality or loading summaries, **TARGET** ranks watersheds based on the evaluation parameters and thresholds selected by the user. This analysis can be used to draw preliminary conclusions based on the wide range of environmental data included in BASINS (e.g., 47 water quality parameters and most of the parameters associated with point source dischargers). The available data are analyzed for each watershed by computing a mean value for the selected parameter. These computed values are then used for comparisons between watersheds.

Procedures

Key Procedures

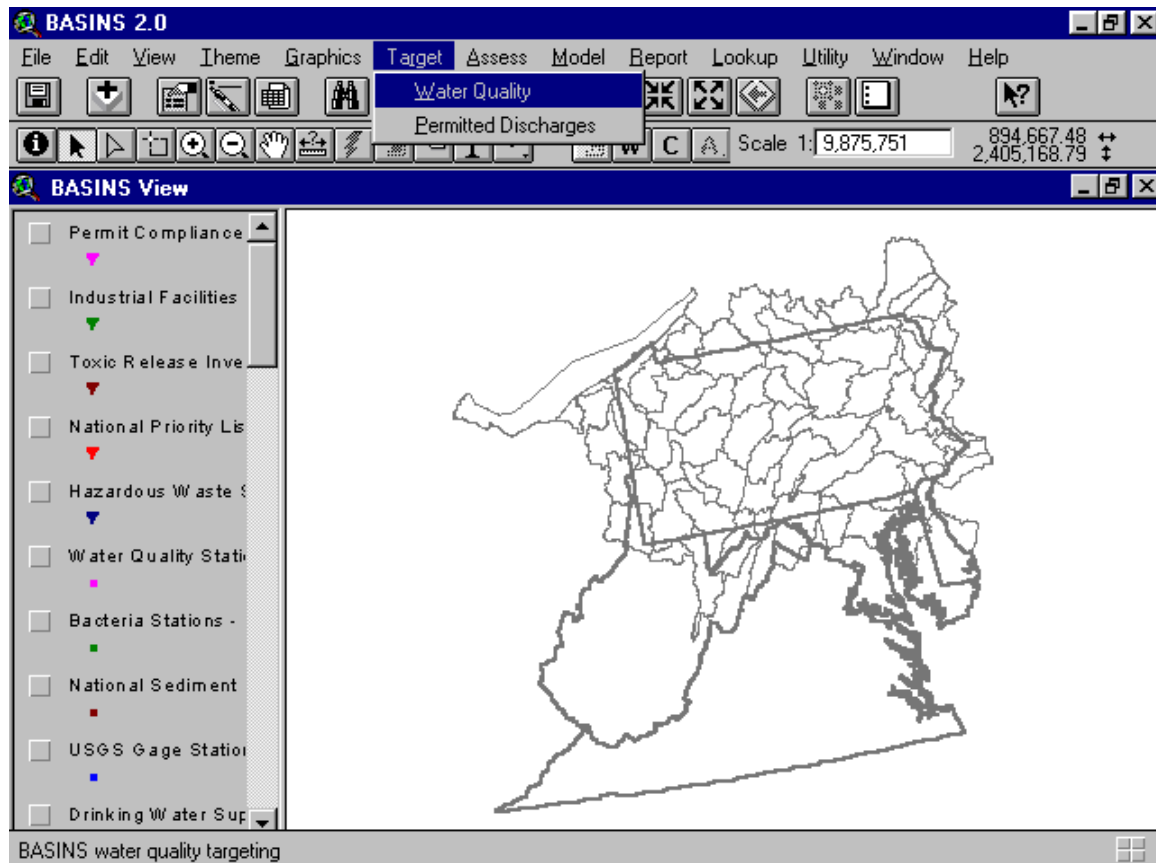
- ✓ *Select Water Quality or Permitted Discharges from the TARGET pull-down menu*
- ✓ *Select monitoring time period*
- ✓ *Select monitoring parameter to be evaluated*
- ✓ *Select desired statistical summary*
- ✓ *Enter threshold value (criterion)*



1. With BASINS View active, click the **TARGET** menu and select either *Water Quality* or *Permitted Discharges* (Screen 6.1.1).

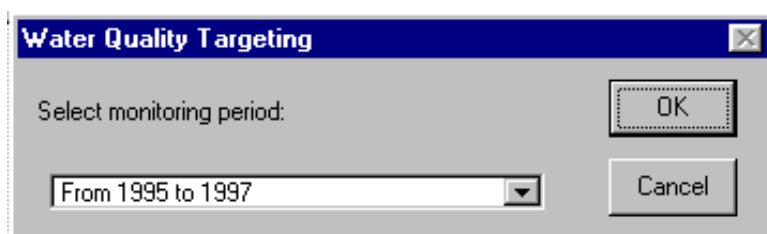
The remaining **TARGET** steps and associated screen captures are similar for both Water Quality and Permitted Discharges. The following examples correspond to a **TARGET** session using the Water Quality option.

Tip: *TARGET automatically performs the analysis for the entire extracted project area. There is no need to select an area for analysis.*



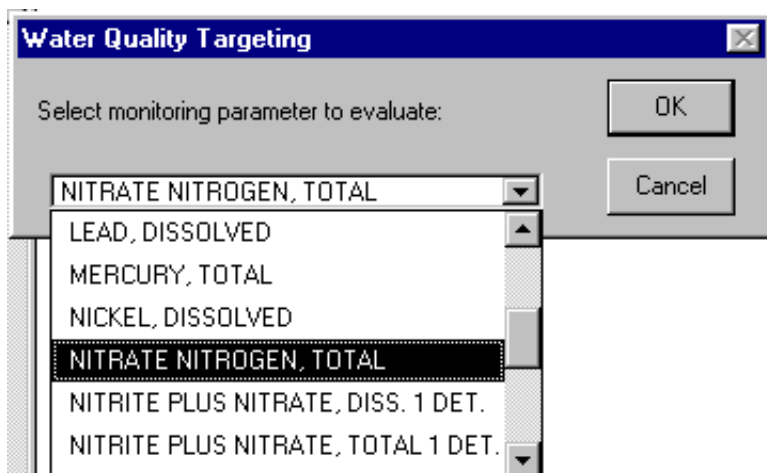
Screen 6.1.1

2. Select a monitoring period for **TARGET** to use for this session (Screen 6.1.2). Statistical summaries of monitoring data for each water quality station or permitted facility are provided for six time periods spanning 1974 to 1997. The statistical summaries are for station data spanning a 5-year period (3-year period for 1995-1997). Descriptive statistics (mean; 15th, 25th, 50th, 75th, and 85th percentiles) are provided for 47 physical and chemical-related parameters at each water quality monitoring station. Refer to Appendix A for additional information on water quality monitoring and permitted discharge data included in BASINS.



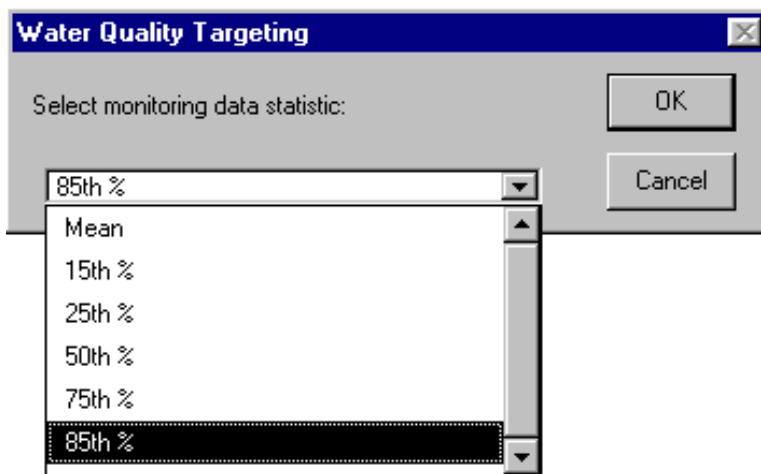
Screen 6.1.2

3. Select a parameter to evaluate (Screen 6.1.3).



Screen 6.1.3

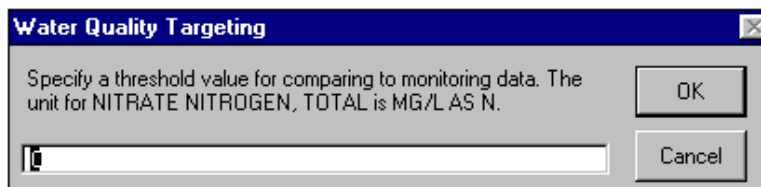
4. Select the desired summary statistics to be used for **TARGET** analysis (Screen 6.1.4).



Screen 6.1.4

5. Specify a threshold value for the selected monitoring parameter (Screen 6.1.5). The threshold value can be a regulatory water quality standard, a discharge standard, or a project-specific value. The default value is zero. As described below, the threshold value will be used to summarize the number of times the value is exceeded based on the monitoring data statistical summaries.

Tip: Water quality criteria for selected parameters are available in BASINS under the Water Quality Criteria Lookup Table, which can be activated under the Lookup menu. Refer to Section 7.6 for details on how to use lookup tables.



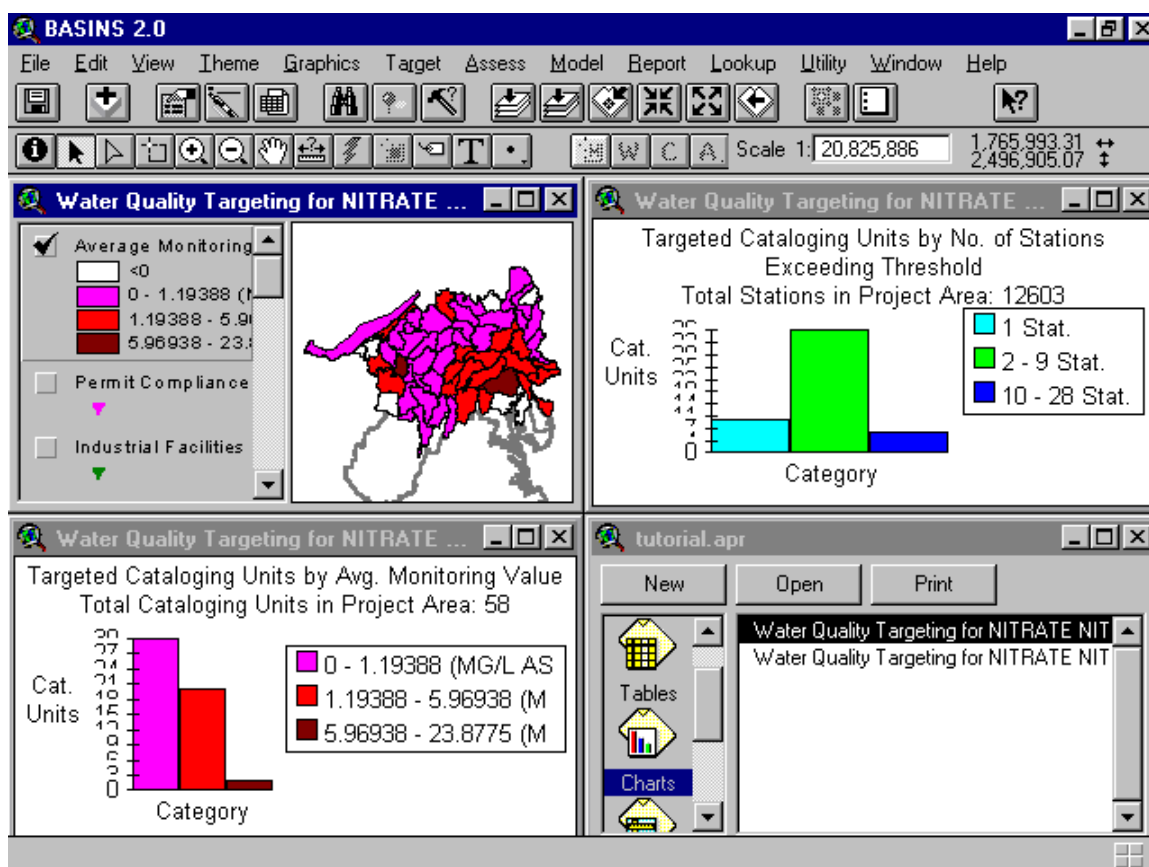
Screen 6.1.5

6. The **TARGET** session ends by generating three output windows (Screen 6.1.6) that summarize the results in map and graphical form:
 - A map displaying the average monitoring value computed for each watershed (hydrologic cataloging unit) based on the user-specified parameter, statistical summary, and threshold value.
 - A bar chart that shows the distribution of cataloging units with respect to the number of stations exceeding the selected threshold value.

- A bar chart that summarizes the distribution of cataloging units with respect to the average monitoring values.

Tip: You can repeat this analysis using different monitoring time periods, parameters, and threshold values. You can also apply TARGET to the evaluation of point source information, using the same steps.

Tip: TARGET will notify you if no data are available for the selected parameter or if there are no data exceeding the selected threshold value.



Screen 6.1.6



TUTORIAL

- Select water quality from the TARGET pull-down menu (Screen 6.1.1).
- Select the following values for the given parameters:
 - Monitoring period = 1995 to 1997 (Screen 6.1.2)
 - Water quality monitoring parameter = "Nitrate Nitrogen, Total" (Screen 6.1.3)
 - Statistical Summary = 85th percentile (Screen 6.1.4)
 - Threshold value = 0 (Screen 6.1.5)

This TARGET session will generate a view showing the 85th percentile statistical summary of nitrate data collected between 1995 and 1997 for each watershed in the study area. Because a threshold value of zero was selected, all available data will be shown on the view. Watersheds that do not have data for the selected parameter are illustrated by the "< 0" classification in the legend. Screen 6.1.6 shows the output for this TARGET session. (Note: If a threshold value is selected, only watersheds with summary data values greater than the threshold value will be displayed. All other watersheds will be grouped into the "< threshold value" classification.)

6.2 ASSESS

Purpose

The BASINS **ASSESS** tool allows users to perform water quality and point source discharge assessment on an individual watershed or a group of watersheds. The water quality assessment relies on the water quality statistical summaries database. It evaluates each monitoring station separately and provides a comparative view of the water quality condition at each station. The point source discharge assessment uses the Permit Compliance System (PCS) stations and corresponding data to produce a comparative view of sources based on the magnitude of their loading discharges.

Application

ASSESS is the second geographically based analytical tool developed in the BASINS GIS environment. It is a simple assessment tool that allows the user to evaluate water quality and point source loading data for individual stations or facilities within a given watershed (cataloging unit) or group of watersheds. Following a **TARGET** analysis performed on a regional or state level, the user can apply **ASSESS** to examine in more detail those watersheds identified as areas of concern. Because it operates on individual stations (or point sources), it has several applications, including the following: evaluation of stream conditions, establishment of preliminary relationships between in-stream water quality conditions and potential sources and causes, and evaluation of monitoring programs and availability of monitoring data for selected water quality parameters.

Procedures

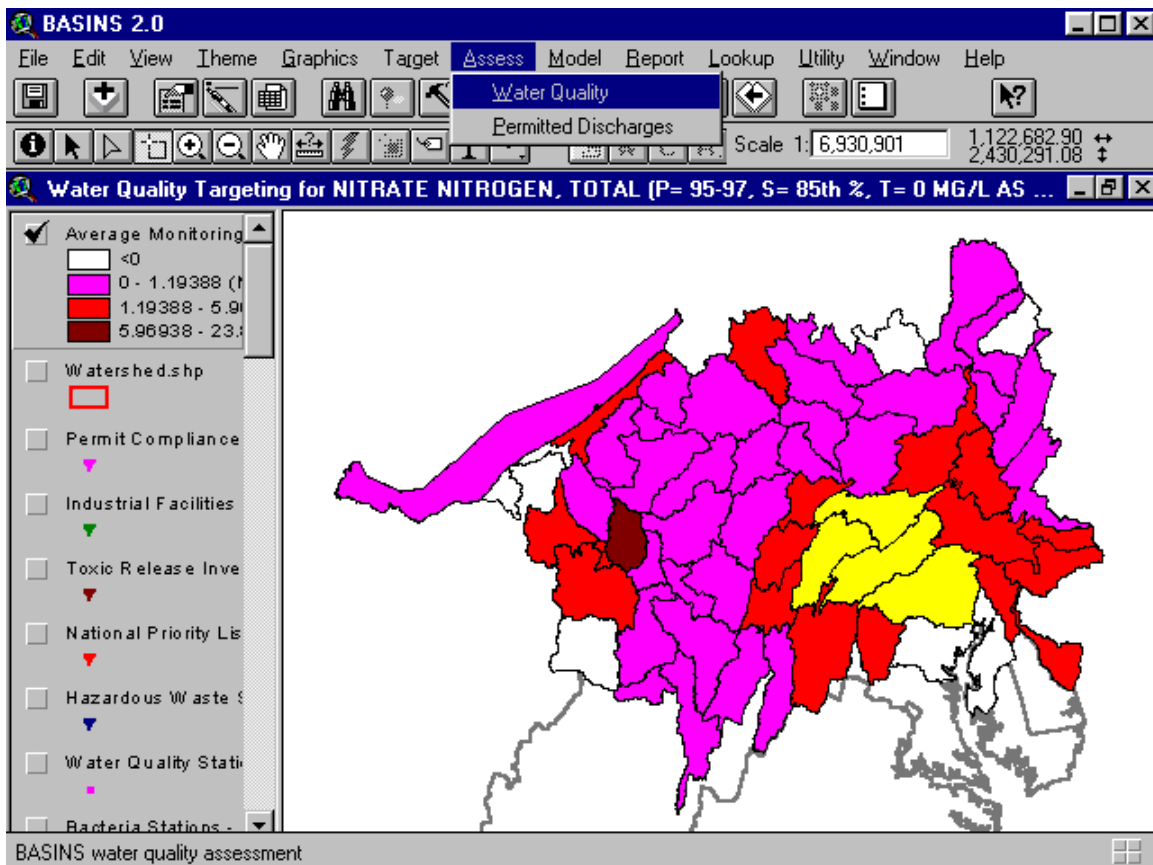
Key Procedures

- ✓ *Activate Cataloging Unit theme*
- ✓ *Select watershed(s)*
- ✓ *Select Water Quality or Permitted Discharges from the ASSESS pull-down menu.*
- ✓ *Select monitoring time period*
- ✓ *Select monitoring parameter to be evaluated*
- ✓ *Select desired statistical summary on which the analysis will be performed*



1. Select one or more watersheds of interest using the **Select Feature** tool. Watersheds can be selected from BASINS View or the targeting view generated by a **TARGET** analysis, as shown in Screen 6.2.1. In BASINS View the Cataloging Unit Boundary theme must be active and visible to select a watershed. The Average Monitoring Value theme must be active and visible if selecting the watershed from the generated targeting views.

Tip: *ASSESS can be run by selecting one or more watersheds within BASINS view, or the Water Quality or Permitted Discharges views generated using TARGET.*

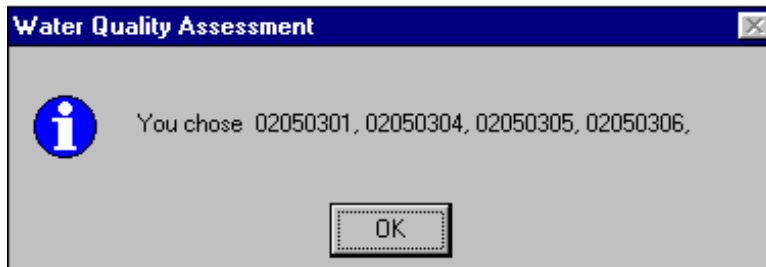


Screen 6.2.1

2. Pull down the **ASSESS** menu and select either *Water Quality* or *Permitted Discharges* (Screen 6.2.1).

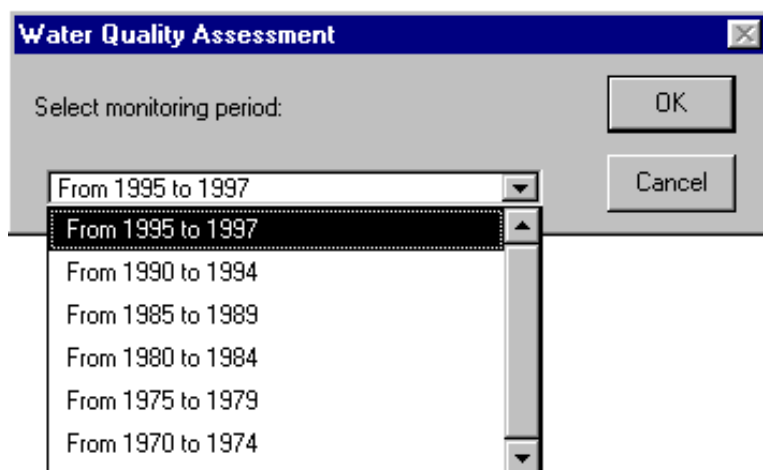
The remaining **ASSESS** steps and associated screens are similar for both Water Quality and Permitted Discharges. The following examples correspond to an **ASSESS** session using the Water Quality option.

3. The system identifies which cataloging units are selected and prompts you for confirmation (Screen 6.2.2).



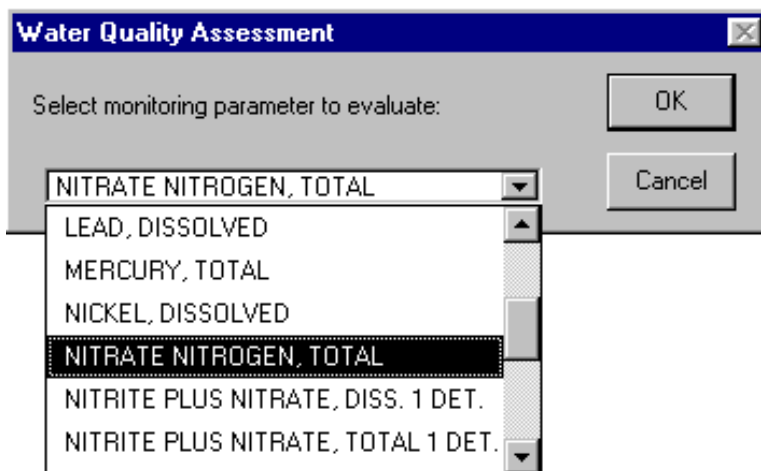
Screen 6.2.2

4. Select a monitoring time period to use for this session (Screen 6.2.3). Note that water quality statistical summaries are provided for 5-year time periods spanning the years 1970 to 1997; the 1995 to 1997 time period includes only 3 years of data. Descriptive statistics (mean; 15th, 25th, 50th, 75th, and 85th percentiles, as well as the number of water quality observations and standard deviation) are provided for each time period and include summary data for 50 physical and chemical-related parameters. Refer to Appendix A for additional information on the water quality monitoring and permitted discharge data included in BASINS.



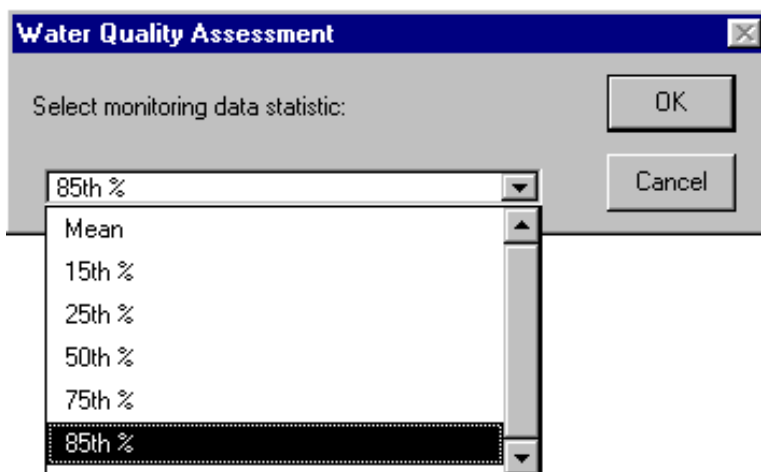
Screen 6.2.3

5. Select a parameter to evaluate (Screen 6.2.4).



Screen 6.2.4

6. Select a water quality summary statistic to use for **ASSESS** analysis (Screen 6.2.5).



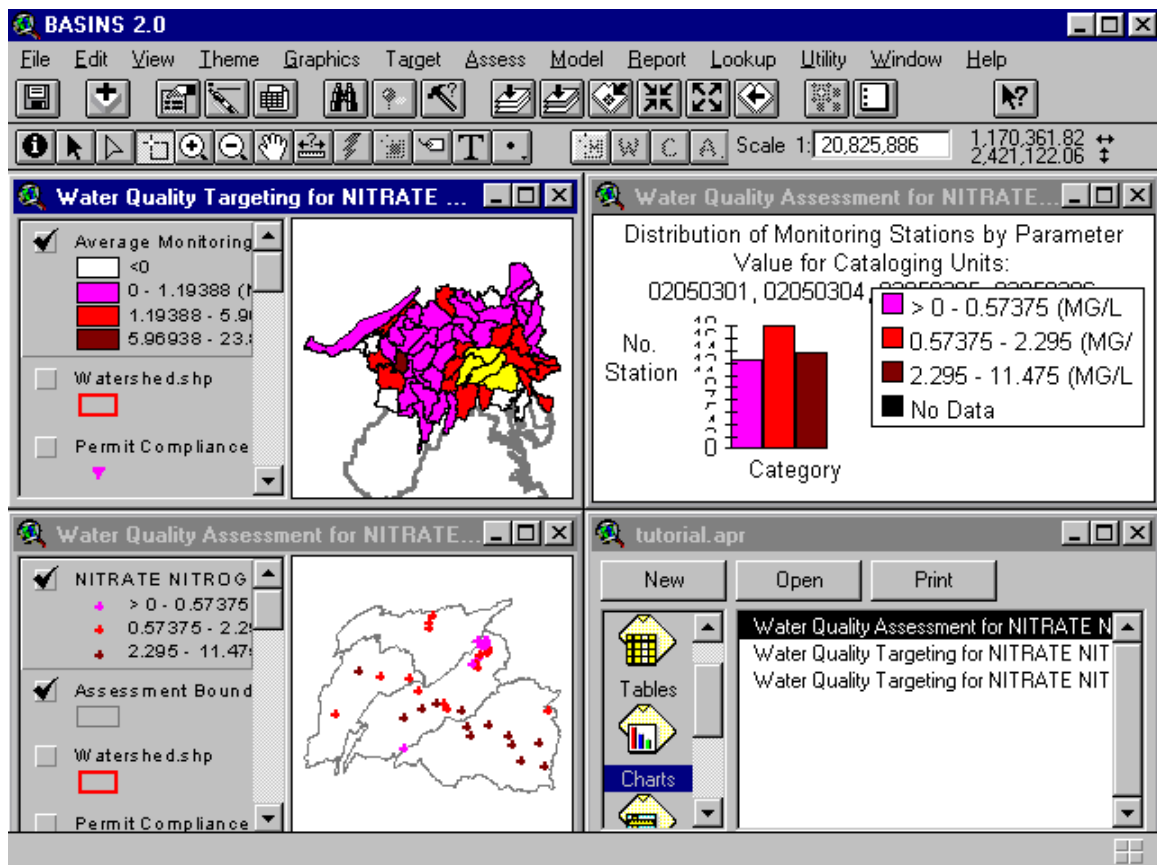
Screen 6.2.5

7. The **ASSESS** session ends by generating two output windows that summarize the results (Screen 6.2.6):
 - A map with water quality stations ranked according to the average monitoring value for the selected time period, selected water quality parameter, and corresponding statistical summary data.
 - A bar chart displaying the distribution of the stations based on the monitoring value

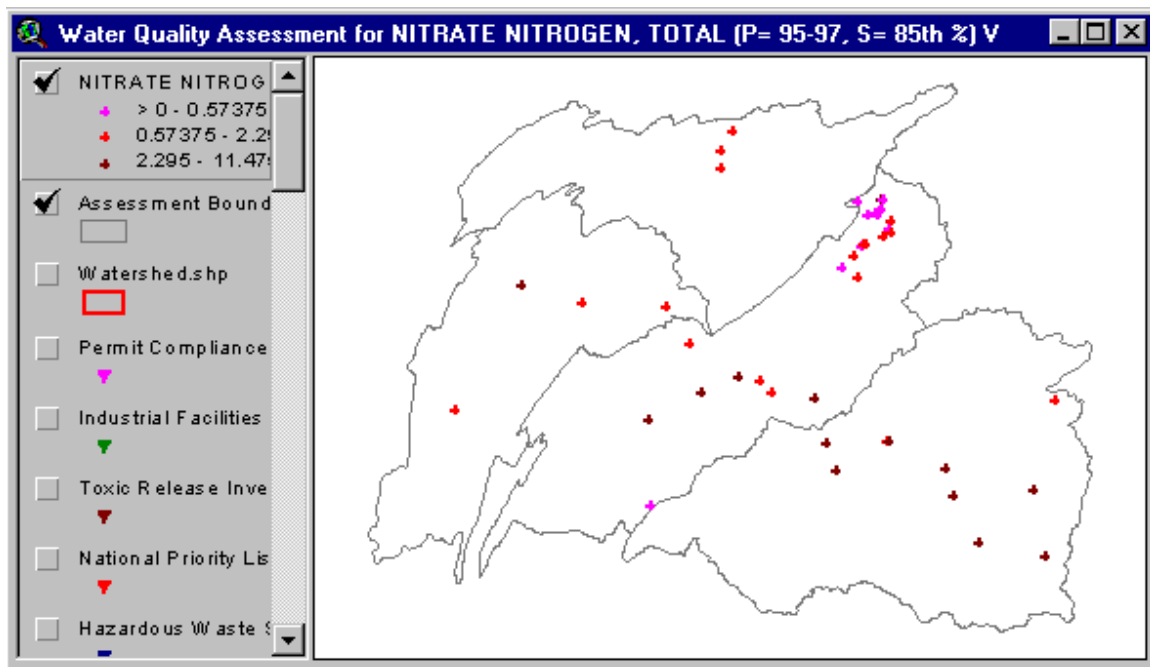
Tip: Use overlays of other BASINS data layers (e.g., land use, Permit Compliance System) to establish a preliminary relationship between in-stream water quality conditions and other upstream sources.

Tip: You can repeat this analysis iteratively using different monitoring time periods and parameters. Through this iterative analysis, you can establish the changes in a given parameter over time (e.g., compare the 1995-1997 water quality parameter values at a given station to those of 1970-1974).

- Use the ArcView **Identify** tool to examine data for selected stations. Screen 6.2.7 shows an expanded view of the station distribution map and the information table for a selected station containing the station reference, concentration value, and parameter measurement unit.



Screen 6.2.6



Screen 6.2.7

TUTORIAL

In the water quality targeting view generated with **TARGET**, select cataloging units 02050301, 02050304, 02050305, and 02050306. These cataloging units can be identified by activating the attributes table for the Average Monitoring Value theme and querying the table on the "Cu" field. Refer to ArcView HELP files for additional information on how to query an attributes table.

- Select Water Quality from the **ASSESS** pull-down menu (Screen 6.2.1)
- Confirm that the appropriate cataloging units were selected (Screen 6.2.2).
- Select the 1995-1997 time period as the period for the analysis (Screen 6.2.3).
- Select "Nitrate Nitrogen, Total" as the parameter of concern (Screen 6.2.4).
- Select 85th percentiles for the statistical summary data to be used for the analysis (Screen 6.2.5).

6.3 Data Mining

Purpose

Data Mining builds dynamic links between the map interface and related data tables to allow users to retrieve and visualize (1) water quality stations and parameter data, (2) permitted facility locations and pollutant loading discharge data, and (3) bacteria stations and corresponding parameter values.

Application

Data Mining is a tool that allows the user to retrieve and visualize BASINS water quality and point source loading data using a dynamic linkage between various related data sets. It has several technical applications, including the following:

- When used in conjunction with **TARGET** and **ASSESS**, it allows examination of impaired stream reaches and the geographical extent of potential water quality problems.
- It provides station-level statistical summaries of water quality condition for six time periods (1970-1974, 1975-1979, 1980-1984, 1985-1989, 1990-1994, and 1995-1997). Changes in water quality condition as reflected in the statistical summaries are indicative of potential trends.
- When used in combination with other data layers, including upstream land use distribution and point source location, it provides a powerful tool for examining potential pollution sources and causes.
- Because it establishes a dynamic link between station locations and their corresponding loading or concentrations for all parameters monitored, it can be used to support various analyses of monitoring programs; assess the availability of monitoring data; and identify data gaps in terms of geographic station coverage, monitoring periods, and monitoring parameters.

The unique relational process established by **Data Mining** provides an integrated approach to GIS and regional data management. It brings environmental data closer to watershed and water quality analysts and allows for a detailed analysis at the site-specific level.



Procedures

Key Procedures

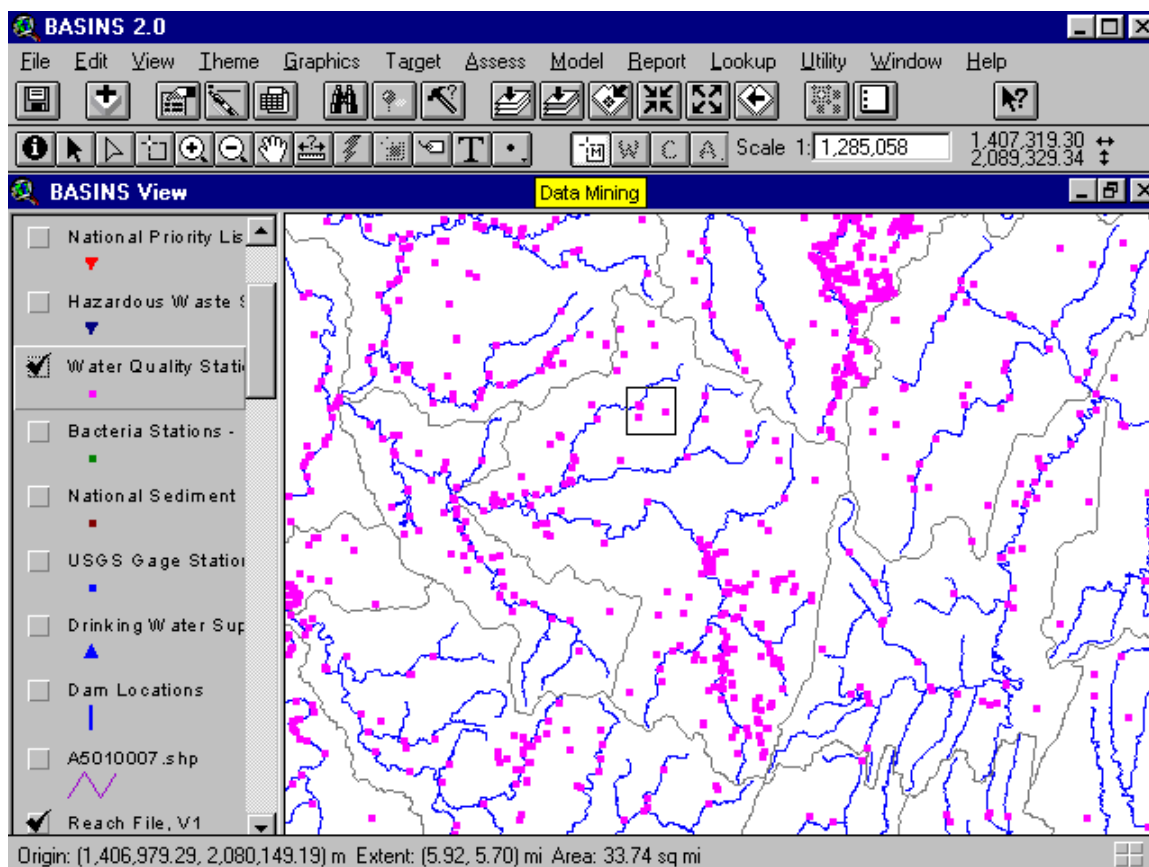
- ✓ *Activate appropriate theme*
- ✓ *Activate Data Mining Feature tool button*
- ✓ *Use mouse to select stations or facility locations*
- ✓ *Select a data point or record on the resulting map or tables to review data for a given station or facility*

1. Activate the Water Quality Station, Bacteria Station, or Permit Compliance System theme by clicking on the theme name. Check the box next to the selected theme for display on the BASINS view.

The remaining steps are the same for water quality, bacteria, or PCS data. The following example corresponds to a ***Data Mining*** session using the Water Quality Station theme.

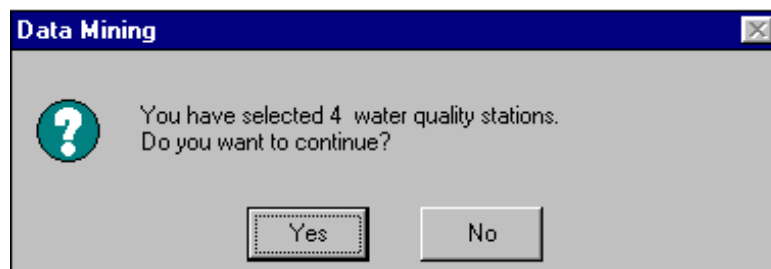
2. Using the **Zoom In** tool, zoom to a scale suitable for selecting the desired water quality stations.
3. Activate the **Data Mining Feature** tool button.
4. Select one or more stations, dragging a box around the stations/area of interest (Screen 6.3.1).

Tip: *Although Data Mining can operate on an unlimited number of monitoring stations, it is best to limit the selected stations to a reasonable number to maximize the functionality of the tool.*



Screen 6.3.1

The system determines the number of stations selected and prompts you for confirmation (Screen 6.3.2). Click **Yes** to continue.



Screen 6.3.2

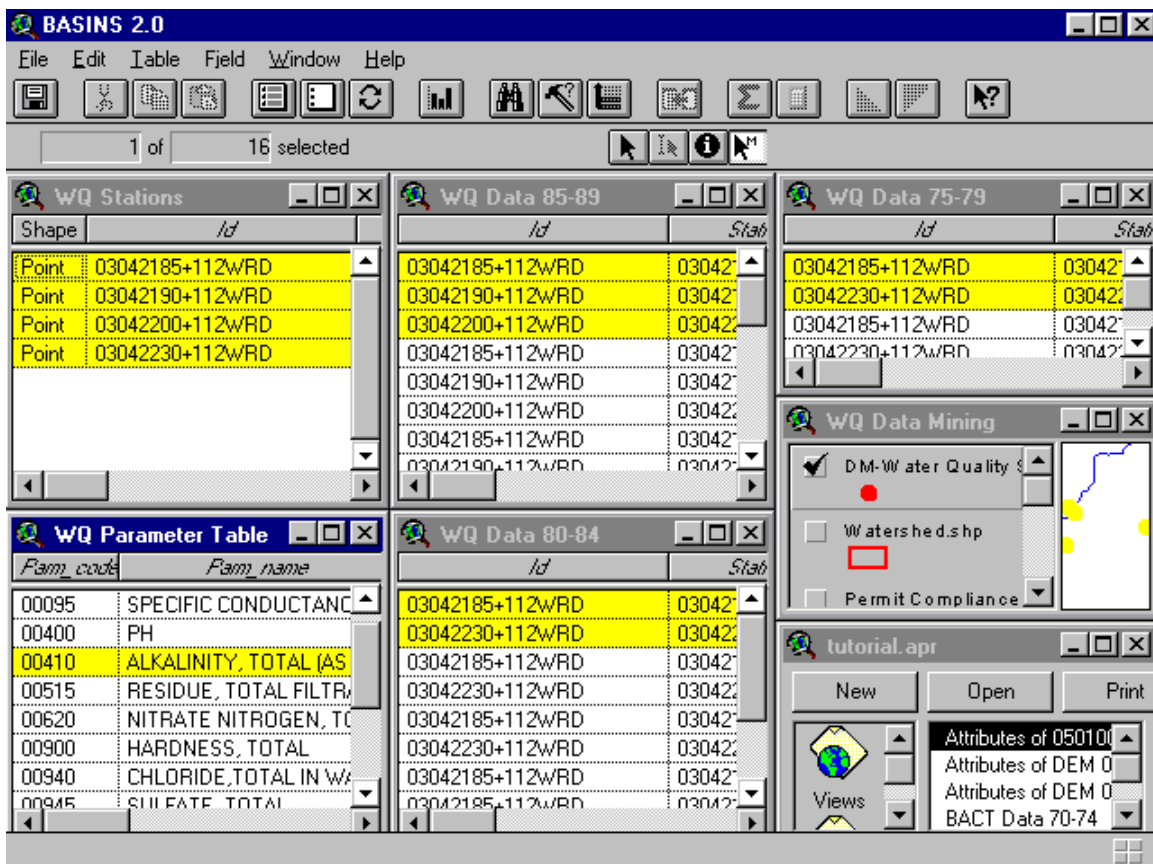
5. Upon confirmation, **Data Mining** builds the appropriate relational data tables and corresponding data mining map (Screen 6.3.3). The following tables and map will be linked:
 - Water Quality Station Table
 - Water Quality Parameter Table



- Water Quality Data Tables (one table for each statistical summary table).
- Water Quality Data Mining View

A **Data Mining** analysis of bacteria stations will generate a similar set of tables with bacteria data. PCS **Data Mining** analysis will generate up to six permitted discharges data tables for the years 1991 through 1996 that include annual loading rates. Refer to Appendix A for additional information on the data products included in BASINS.

Tip: Only the data tables that contain data for the selected station(s) or facilities will be displayed. For example, if water quality data are available for only 1975 to 1989 for the selected station(s), only three water quality data tables will be displayed in the Data Mining results (1975-1979, 1980-1984, and 1985-1989).



Screen 6.3.3

6. Close all the windows except the project APR view to exit **Data Mining**.

Tip: Data tables and maps generated by Data Mining will be overwritten every time this function is run; therefore, the results will not be permanently saved when the project is saved.

TUTORIAL

- Activate the Water Quality Station theme by clicking on the theme name.
- Check the box next to the theme name to display the theme on the map.
- Select the following stations using the **Data Mining Feature** tool 03042185, 03042190, 03042230, and 03042200 (Screen 6.3.1). When prompted, confirm that the stations are selected (Screen 6.3.2).
- Once the **Data Mining** tables and maps have been generated, click on the Water Quality Parameter Table to activate it. All subsequent linkages will be based on water quality parameters.
- Click on "Alkalinity, Total (as mg/l CaCO₃)" to select this parameter. Note that stations that have measured alkalinity data are highlighted in the Water Quality Stations Table and in the Water Quality Data Mining map. Data records are also highlighted in each of the water quality data tables (Screen 6.3.3).
- Click on the Water Quality Stations title box to activate it. This changes the focus from parameters to stations.
- Click on a station record. Now, all of the parameters measured by this station are highlighted in the Water Quality Parameter Table, as well as in the water quality data tables. Selected stations are also highlighted on the Data Mining map. If you select a station on the Data Mining map, the data records corresponding to the selected station will be highlighted.